Amendments to Specification

Please replace the paragraphs beginning on page 4, at lines 7, 10, 13 and 16, with the following rewritten paragraphs:

Embodiments of ~~It is therefore an object of~~ the present invention will be seen variously:

to develop a probabilistic image model for ultrasound applicable to the Bayesian, model-based approach to image analysis;~~.~~

~~Another object of the present invention is~~ to include the gross shape, the surface microstructure and the imaging system point spread function into the probabilistic model for ultrasound;~~.~~

~~Still another object of the present invention is~~ to develop a probabilistic model for ultrasound requiring minimal computational demands while providing accurate characterization of the pixel intensity variation across the image; and ~~.~~

~~Yet another object of the present invention is~~ to develop a probabilistic model for ultrasound providing a representation suitable for construction of a data likelihood for the image offering smooth variation for changes in the object shape making the probabilistic model suitable to derivative based optimization techniques for inference.

Please replace the paragraph beginning on page 5, line 12, with the following rewritten paragraph:

Figure 3 illustrates an actual image at top left and two ~~three~~ simulated images at bottom left of the transverse process with corresponding statistical images at right, the images developed in accordance with the present invention, where the images show only the

small, approximately 6mm axially and 15mm laterally, portion of the entire image that represent scattering from the transverse process, the statistical images show the variation of the mean~~, standard deviation~~ and SNR_0 across the image~~, the simulated images were generated for three different realizations of the microstructure, while the statistical images were computed directly from the model to characterize all possible images~~;

Please replace the Section Heading on page 19, line 17, with the following Section Heading:

~~VI.~~ IV. METHODS

Please replace the paragraph beginning on page 24, line 6, with the following rewritten paragraph:

In the left column of Figure 3, the actual image is shown above two ~~three~~ of the infinite set of possible simulated images. Substantial variation exists among the simulated images and is representative of the variability expected from the physical model. The actual image appears quite similar to the simulated images in shape, but the actual image seems to have a wider region of bright echoes along the top of the process with a greater relative amplitude to the other echoes. Close inspection of the shape in the images shows that it is visibly rotated counter-clockwise in the simulated images. Given the sensitivity to the angle of insonification, such a change could easily account for many of the differences between the images. These differences are unavoidable since the tracking error is on the order of 2 mm.

Please add the following paragraphs at page 29, line 11, before the paragraph that begins "These and other advantages of the ..."

Accordingly, the above Sections describe various methods and apparatus for forming an image model and for developing a physically-based, probabilistic model for ultrasonic images to accurately represent shape. The models allow inference of underlying structural patterns in the image data. The present invention further includes computer readable media that configures a computer to perform the methods described herein.

Figures 7-10 illustrate flow diagrams outlining various method steps, and showing structure of programs capable of being stored on computer readable media, to create physically-based, probabilistic models for ultrasonic images in accordance with certain embodiments of the present invention. Figure 7 illustrates forming a probabilistic model by creating a representative physical model of image formation 710, and creating a random phasor sum representation of the physical model to form the probabilistic model 720.

Figure 8 illustrates steps for creating a representative physical model of image formation, including forming imaging system characteristics 810, forming shape 820, forming microstructure 830, and then incorporating the imaging system characteristics, the shape and the microstructure to create the imaging model 840.

Figure 9 illustrates one embodiment for forming microstructure using image pixel-based statistics. The steps include computing an amplitude mean value, an amplitude variance value and a ratio of the amplitude mean to a standard deviation value at each image pixel to develop a statistical image characterizing tissue 910; classifying each image pixel as Rayleigh or Gaussian depending on the ratio of the amplitude mean to the standard deviation value 920; assigning a density function to each image pixel based upon the classification of

each image pixel 930; and constructing the data likelihood as a product of the density functions.

Figure 10 illustrates another embodiment for forming a physically-based, probabilistic model for ultrasonic images by creating a representative physical model of image formation 1010 and creating a random phasor sum representation of the physical model to form the probabilistic model 1020. In this embodiment, the physical model of image formation is created by developing a deterministic description of imaging system characteristics 1212, developing a deterministic description of gross shape 1014, developing a random description of microstructure 1016, and incorporating the imaging system characteristics, the gross shape and the microstructure to form the model 1018.